We Claim:

1.    A method for processing images, the method comprising:

     act A: converting a first image data from a first color space into a second image

          data that corresponds to a second color space;

     act B: perform image processing on the second image data in the second color

          space to form a processed image data; and

     act C: converting the processed image data to a third image data that

          corresponds to any one color space from a set of color spaces, the set of

          color spaces comprising:

               the first color space;

               a third color space; and

               the second color space but using a conversion method that is

                    different from a conversion method that is used to perform

                    act A.

2.    The method of Claim 1, wherein the first color space is a single color component color space.

3.    The method of Claim 1, wherein the first color space is a multiple color component color space.

4.    The method of Claim 1, wherein the first color space includes any one of a second set of color spaces, the set comprising:

3         RGB raw space;

4         RGB composite space;

5         $YC_bC_r$ space;

6         YUV space;

7         YIQ space;

8         $YD_bD_r$ space;

9         YCC space;

10        HSI space;

11        HLS space;

12        HSV space;

13        CMY space; and

14        CMYK space.


1   5.    The method of Claim 1, wherein the second color space is a single color

2        component color space.


1   6.    The method of Claim 1, wherein the second color space is a multiple color

2        component color space.


1   7.    The method of Claim 1, wherein the second color space includes any one of a

2        third set of color spaces, the set comprising:

3        RGB raw space;

4        RGB composite space;

5      $YC_bC_r$ space;

6      YUV space;

7      YIQ space;

8      $YD_bD_r$ space;

9      YCC space;

10     HSI space;

11     HLS space;

12     HSV space;

13     CMY space; and

14     CMYK space.


1   8.   The method of Claim 1, wherein the third color space is a single color component

2        color space.


1   9.   The method of Claim 1, wherein the third color space is a multiple color

2        component color space.


1   10.  The method of Claim 1, wherein the third color space includes any one of a

2        fourth set of color spaces, the set comprising:

3        RGB raw space;

4        RGB composite space;

5        $YC_bC_r$ space;

6        YUV space;

7        YIQ space;

8        $YD_bD_r$ space;

9        YCC space;

10       HSI space;

11       HLS space;

12       HSV space;

13       CMY space; and

14       CMYK space.


1   11.     The method of Claim 1, wherein act A further comprises using one or more

2            temporary buffers to store the second image data.


1   12.     The method of Claim 1, wherein act B further comprises using one or more

2            temporary buffers to store the processed image data.


1   13.     The method of Claim 1, wherein act B further comprises one or more of the

2            following:

3            performing auto white balance;

4            performing auto exposure control;

5            performing gamma correction;

6            performing edge detection;

7            performing edge enhancement;

8            performing color correction;

9          performing cross-talk compensation;

10         performing hue control;

11         performing saturation control;

12         performing brightness control;

13         performing contrast control;

14         performing de-noising filters;

15         performing smoothing filters;

16         performing decimation filters;

17         performing interpolation filters;

18         performing image data compression;

19         performing white pixel correction;

20         performing dead pixel correction;

21         performing wounded pixel correction;

22         performing lens correction;

23         performing frequency detection;

24         performing indoor detection;

25         performing outdoor detection; and

26         applying special effects.


1    14.   The method of Claim 1, wherein act A further comprises performing a color

2          interpolation for converting each pixel that is associated with the first image data

3       from a single color component to a multiple color component to form a

4       corresponding interpolated pixel.

5   15.   The method of Claim 14, further comprising applying a conversion equation to

6       each interpolated pixel, wherein the conversion equation is selected based on

7       the second color space.

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9   16.   The method of Claim 1, wherein act A further comprises applying a conversion

10       equation to each pixel, wherein the conversion equation is selected based on the

11       second color space.

1   17.   The method of Claim 14, wherein performing a color interpolation further

2       comprises deriving missing color components for each pixel from the pixel's

3       neighboring pixels, wherein the neighboring pixels contain the missing color

4       components.

1   18.   The method of Claim 17, wherein deriving missing color components for each

2       pixel from the pixel's neighboring pixels comprises one or more of the following

3       acts:

4       act P: deriving missing color components for each pixel from the pixel's closest

5            previous and next pixels in a horizontal direction, wherein the closest

6            previous and next pixels contain the missing color components;

7    act Q: deriving missing color components for each pixel that has no previous

8         pixel in the horizontal direction from the pixel's closest next pixel in the

9         horizontal direction, wherein the next pixel contain the missing color

10        components;

11    act R: deriving missing color components, for each pixel that has no next pixel in

12        the horizontal direction, from the pixel's closest previous pixel in the

13        horizontal direction, wherein the previous pixel contain the missing color

14        components;

15    act S: deriving missing color components for a line of pixels from a previous line

16        of pixels, wherein the previous line of pixels contain the missing color

17        components; and

18    act T: using a fixed number for each missing color component for the line of

19        pixels if there is no previous line of pixels.


1    19.   The method of Claim 18, wherein act P further comprises averaging the pixel's

2         closest previous and next pixels in the horizontal direction.


1    20.   The method of Claim 18, wherein act P further comprises using a weighting

2         function on the pixel's closest previous and next pixels in the horizontal direction.


1    21.   The method of Claim 18, wherein act S further comprises averaging pixels

2         corresponding to each missing color component from the previous line of pixels.

1 22. The method of Claim 18, wherein act S further comprises applying a weighting

2 function to pixels corresponding to each missing color component from the

3 previous line of pixels.

1 23. The method of Claim 18, wherein the fixed number is based on missing color

2 components from previous frames.

1 24. The method of Claim 14, further comprising using one or more filters, wherein the

2 one or more filters include:

3 finite impulse response (FIR) filters;

4 infinite impulse response (IIR) filters;

5 low-pass filters;

6 high-pass filters;

7 band-pass filters;

8 band-stop filters;

9 all-pass filters;

10 anti-aliasing filters;

11 decimation (down-sampling) filters; and

12 interpolation (up-sampling) filters.

1 25. The method of Claim 14, further comprising using filters before performing the

2 color interpolation.

1    26.    The method of Claim 14, further comprising using filters after performing the

2          color interpolation.


1    27.    The method of Claim 14, further comprising using filters before and after

2          performing the color interpolation.


3    28.    The method of Claim 14, wherein performing a color interpolation further

4          comprises using  one or more of the following interpolation methods:

5          nearest neighbor interpolation;

6          bilinear interpolation;

7          cubic interpolation;

8          Laplacian interpolation;

9          adaptive Laplacian interpolation;

10         smooth hue transition;

11         smooth hue transition Log interpolation;

12         edge sensing interpolation;

13         variable number of gradients;

14         pattern matching interpolation;

15         linear color correction interpolation; and

16         pixel grouping interpolation.

17    29.    The method of Claim 1, wherein act C further comprises re-mapping each pixel

18             of the processed image data into the selected color space.

1    30.    The method of Claim 1, wherein act C further comprises applying a conversion

2             equation to each pixel of the processed image data, wherein the conversion

3             equation is selected based on a selected color space from the set of color

4             spaces.

1    31.    The method of Claim 30, further comprising, after applying the conversion

2             equation, re-mapping each pixel of the processed image data into the selected

3             color space.

4    32.    The method of Claim 31, wherein re-mapping includes dropping undesired color

5             components.

1    33.    The method of Claim 32, further comprising using filters before dropping

2             undesired color components.

1    34.    The method of Claim 32, further comprising using filters after dropping undesired

2             color components.

1    35.    The method of Claim 32, further comprising using filters before and after

2             dropping undesired color components.

36. A computer-readable medium carrying one or more sequences of instructions for computing degrees of parallelism for parallel operations in a computer system, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the acts of:

act A: converting a first image data from a first color space into a second image data that corresponds to a second color space;

act B: perform image processing on the second image data in the second color space to form a processed image data; and

act C: converting the processed image data to a third image data that corresponds to any one color space from a set of color spaces, the set of color spaces comprising:

the first color space;

a third color space; and

the second color space but using a conversion method that is different from a conversion method that is used to perform act A.

37. The computer-readable medium of Claim 36, wherein the first color space is a single color component color space.

38. The computer-readable medium of Claim 36, wherein the first color space is a multiple color component color space.

1    39.    The computer-readable medium of Claim 36, wherein the first color space

2          includes any one of a second set of color spaces, the set comprising:

3          RGB raw space;

4          RGB composite space;

5          $YC_bC_r$ space;

6          YUV space;

7          YIQ space;

8          $YD_bD_r$ space;

9          YCC space;

10        HSI space;

11        HLS space;

12        HSV space;

13        CMY space; and

14        CMYK space.

1    40.    The computer-readable medium of Claim 36, wherein the second color space is

2          a single color component color space.

1    41.    The computer-readable medium of Claim 36, wherein the second color space is

2          a multiple color component color space.

1  42.  The computer-readable medium of Claim 36, wherein the second color space

2      includes any one of a third set of color spaces, the set comprising:

3      RGB raw space;

4      RGB composite space;

5      $YC_bC_r$ space;

6      YUV space;

7      YIQ space;

8      $YD_bD_r$ space;

9      YCC space;

10     HSI space;

11     HLS space;

12     HSV space;

13     CMY space; and

14     CMYK space.

1  43.  The computer-readable medium of Claim 36, wherein the third color space is a

2      single color component color space.

1  44.  The computer-readable medium of Claim 36, wherein the third color space is a

2      multiple color component color space.

1  45.  The computer-readable medium of Claim 36, wherein the third color space

2      includes any one of a fourth set of color spaces, the set comprising:

3      RGB raw space;

4      RGB composite space;

5      $YC_bC_r$ space;

6      YUV space;

7      YIQ space;

8      $YD_bD_r$ space;

9      YCC space;

10     HSI space;

11     HLS space;

12     HSV space;

13     CMY space; and

14     CMYK space.


1  46.  The computer-readable medium of Claim 36, wherein act A further comprises

2      using one or more temporary buffers to store the second image data.


1  47.  The computer-readable medium of Claim 36, wherein act B further comprises

2      using one or more temporary buffers to store the processed image data.

1    48.    The computer-readable medium of Claim 36, wherein act B further comprises

2        one or more of the following:

3        performing auto white balance;

4        performing auto exposure control;

5        performing gamma correction;

6        performing edge detection;

7        performing edge enhancement;

8        performing color correction;

9        performing cross-talk compensation;

10        performing hue control;

11        performing saturation control;

12        performing brightness control;

13        performing contrast control;

14        performing de-noising filters;

15        performing smoothing filters;

16        performing decimation filters;

17        performing interpolation filters;

18        performing image data compression;

19        performing white pixel correction;

20        performing dead pixel correction;

21          performing wounded pixel correction;

22          performing lens correction;

23          performing frequency detection;

24          performing indoor detection;

25          performing outdoor detection; and

26          applying special effects.


1    49.    The computer-readable medium of Claim 36, wherein act A further comprises

2          performing a color interpolation for converting each pixel that is associated with

3          the first image data from a single color component to a multiple color component

4          to form a corresponding interpolated pixel.


5    50.    The computer-readable medium of Claim 49, further comprising applying a

6          conversion equation to each interpolated pixel, wherein the conversion equation

7          is selected based on the second color space.

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9    51.    The computer-readable medium of Claim 36, wherein act A further comprises

10          applying a conversion equation to each pixel, wherein the conversion equation is

11          selected based on the second color space.


1    52.    The computer-readable medium of Claim 49, wherein performing a color

2          interpolation further comprises deriving missing color components for each pixel

3      from the pixel's neighboring pixels, wherein the neighboring pixels contain the

4      missing color components.

1   53.   The computer-readable medium of Claim 52, wherein deriving missing color

2      components for each pixel from the pixel's neighboring pixels comprises one or

3      more of the following acts:

4      act P: deriving missing color components for each pixel from the pixel's closest

5          previous and next pixels in a horizontal direction, wherein the closest

6          previous and next pixels contain the missing color components;

7      act Q: deriving missing color components for each pixel that has no previous

8          pixel in the horizontal direction from the pixel's closest next pixel in the

9          horizontal direction, wherein the next pixel contain the missing color

10          components;

11     act R: deriving missing color components, for each pixel that has no next pixel in

12         the horizontal direction, from the pixel's closest previous pixel in the

13         horizontal direction, wherein the previous pixel contain the missing color

14         components;

15     act S: deriving missing color components for a line of pixels from a previous line

16         of pixels, wherein the previous line of pixels contain the missing color

17         components; and

18        act T: using a fixed number for each missing color component for the line of

19                pixels if there is no previous line of pixels.

1    54.    The computer-readable medium of Claim 53, wherein act P further comprises

2        averaging the pixel's closest previous and next pixels in the horizontal direction.

1    55.    The computer-readable medium of Claim 53, wherein act P further comprises

2        using a weighting function on the pixel's closest previous and next pixels in the

3        horizontal direction.

1    56.    The computer-readable medium of Claim 53, wherein act S further comprises

2        averaging pixels corresponding to each missing color component from the

3        previous line of pixels.

1    57.    The computer-readable medium of Claim 53, wherein act S further comprises

2        applying a weighting function to pixels corresponding to each missing color

3        component from the previous line of pixels.

1    58.    The computer-readable medium of Claim 53, wherein the fixed number is based

2        on missing color components from previous frames.

1    59.    The computer-readable medium of Claim 49, further comprising using one or

2        more filters, wherein the one or more filters include:

3        finite impulse response (FIR) filters;

4          infinite impulse response (IIR) filters;

5          low-pass filters;

6          high-pass filters;

7          band-pass filters;

8          band-stop filters;

9          all-pass filters;

10         anti-aliasing filters;

11         decimation (down-sampling) filters; and

12         interpolation (up-sampling) filters.

1    60.   The computer-readable medium of Claim 49, further comprising using filters

2          before performing the color interpolation.

1    61.   The computer-readable medium of Claim 49, further comprising using filters after

2          performing the color interpolation.

1    62.   The computer-readable medium of Claim 49, further comprising using filters

2          before and after performing the color interpolation.

3    63.   The computer-readable medium of Claim 49, wherein performing a color

4          interpolation further comprises using one or more of the following interpolation

5          methods:

6          nearest neighbor interpolation;

7      bilinear interpolation;

8      cubic interpolation;

9      Laplacian interpolation;

10     adaptive Laplacian interpolation;

11     smooth hue transition;

12     smooth hue transition Log interpolation;

13     edge sensing interpolation;

14     variable number of gradients;

15     pattern matching interpolation;

16     linear color correction interpolation; and

17     pixel grouping interpolation.

18   64.   The computer-readable medium of Claim 36, wherein act C further comprises re-

19        mapping each pixel of the processed image data into the selected color space.

1   65.   The computer-readable medium of Claim 36, wherein act C further comprises

2       applying a conversion equation to each pixel of the processed image data,

3       wherein the conversion equation is selected based on a selected color space

4       from the set of color spaces.

1   66.   The computer-readable medium of Claim 65, further comprising, after applying

2       the conversion equation, re-mapping each pixel of the processed image data into

3       the selected color space.

4    67.    The computer-readable medium of Claim 66, wherein re-mapping includes

5           dropping undesired color components.

·1    68.    The computer-readable medium of Claim 67, further comprising using filters

2           before dropping undesired color components.

1    69.    The computer-readable medium of Claim 67, further comprising using filters after

2           dropping undesired color components.

1    70.    The computer-readable medium of Claim 67, further comprising using filters

2           before and after dropping undesired color components.